ROYAL ASTRONOMICAL SOCIETY.

VOL. VIII. *Supplement.* No. 9.

Dr. Pearson's Practical Astronomy.

THE late Dr. Pearson bequeathed to the Society the stock of his *Introduction to Practical Astronomy* remaining unsold at his death. There are about 100 copies of the entire work, and 400 copies of the first volume, which contains the tables.

The Council have resolved to sell these at the following prices to fellows and associates of the Society:—

	£	s.	d.
The whole work, 2 vols. text, and 1 of plates	1	1	0
The 1st vol., containing all the tables	0	5	0

The price to non-members is double.

Copies are now ready, and it is desirable that they should be applied for soon. So many are already disposed of that it would not be prudent to risk any further delay.

---

*Discovery of a new Satellite of Saturn.** By W. Lassell, Esq.

"In communicating to you the particulars attending the discovery of an eighth satellite of *Saturn*, I shall adopt the proper names proposed by Sir John Herschel for the seven hitherto known satellites, namely, *Mimas*, *Enceladus*, *Tethys*, *Dione*, *Rhea*, *Titan*, and *Japetus*, beginning with the closest, and proceeding in order of distance from their primary. The new satellite I have proposed, in conformity with this nomenclature, to call *Hyperion*.

"On the 18th September, while surveying the planet in the twenty-foot equatoreal, and looking out for *Japetus*, (which I expected to find following the planet and not far from the plane of his ring,) I remarked *two* stars exactly in the line of the interior satellites. Not being certain at the time which of these was *Japetus* (although the nearer of the two certainly seemed too faint), I made a careful diagram of their positions with respect to *Saturn*, and also to some neighbouring fixed stars.

"The next night, the 19th, proved fine, and I was astonished to find that the *two* stars had both moved away from the fixed stars to which they had been referred, and were still accompanying *Saturn;* the more distant of the two had also gone northward, in conformity with the orbital motion of *Japetus*, while the nearer and

* The new satellite was, it is said, discovered at the Observatory of Cambridge, U.S., on Sept. 16th, but no account has been received from Professor Bond.

fainter, remaining precisely in the line of the inferior satellites, appeared to have slightly approached the planet.

"A consideration of this appearance suggested the idea that the more distant was *Japetus*, and that the nearer and fainter must be a new satellite of *Saturn*. To verify the suspicion, I took differences of right ascension between each and a fixed star, and found that in $2^h\ 36^m$ the suspected satellite had moved westward $2^s{\cdot}46$, and that in $1^h\ 24^m$ *Japetus* (the identification of which was now certain) had also moved westward $1^s{\cdot}27$. It is true that these differences are somewhat greater than is consistent with the orbital motion of *Saturn*, yet perhaps not greater than is consistent with reasonable errors of observation during so short a period. Moreover, as the suspected new satellite was situated precisely in the line of the satellites interior to itself, I took micrometrical measurements of its situation at two epochs, four hours apart, and was satisfied that during that interval no perceptible change whatever took place in its position in the line of the satellites. As the motion of *Saturn* southwards in the same period amounted to $18''$, he must have left the suspected satellite obviously behind if it had been a fixed star. I could, therefore, now arrive at no other conclusion than that I had discovered a satellite hitherto undetected.

"I regret that since the 19th September the weather has been remarkably unfavourable. I obtained a good set of measures of the elongation of the satellite on the 21st, and two very hasty measures on the 22d, caught between clouds, which, with an *estimation* of its elongation on the 18th, are all the data I have hitherto obtained towards the determination of its period. Since the latter date the weather has been uniformly cloudy.

"If these observations should be thought worthy of being recorded until better can be obtained, they would stand thus:—

Sept. 18, Elongation east of *Saturn* (estimated by comparison with *Titan*)	$4'\ 20''$
21, Elongation, measured	3 54
22, Ditto ditto	3 27

"These observations would, I believe, be best satisfied by a period of about 24 days, which may at least serve as a guide in looking for the satellite. Its magnitude is very small,—perhaps not intrinsically so great as that of *Mimas*,—though it was much easier to see, on account of its greater distance from the planet.

"During this autumn I have twice been gratified with a sight of the whole seven satellites of *Saturn* at one time, viz. on the 19th August and on the 16th September, at $11^h\ 15^m$. The observations of the latter evening were very interesting. I first saw the planet a little before 10^h, when *Tethys* was behind the planet, and *Enceladus* and *Dione* absolutely in one. I immediately recognised *Mimas*, and in a very short time *Enceladus* emerged from conjunction with *Dione*, and then appeared with the latter as the most delicate double-star possible. At $11^h\ 30^m$ *Titan* had approached close up to the ball, and was apparently in contact with it. At

$11^h\ 35^m$ it had become occulted. At $11^h\ 5^m$ I observed *Tethys* just emerging from behind the ball, and noticed that he emerged evidently *south* of the line joining the other satellites. As the present position of the ring requires that, if revolving in its plane, the satellite should appear rather to the *north* on its emergence, this fact seems to afford some evidence that the satellite does not revolve precisely in the plane of the ring. Moreover, at $11^h\ 50^m$, when *Tethys* and *Mimas* formed an exquisitely delicate double-star, *Tethys* was still south of *Mimas*, although, as *Tethys* was receding from the planet and *Mimas* approaching it, the reverse ought to have been the case if the former really revolves in the plane of the ring.

"At $10^h\ 5^m$ this evening (Sept. 16) *Mimas* was, as nearly as could be estimated, at his greatest elongation eastward; and on the 16th October, 1847, at $8^h\ 35^m$, I observed him at or very near his greatest elongation westward. The interval elapsing amounts to 336·045 days; and supposing him to have made in that time 356·5 revolutions, $22^h\ 37^m\ 22^s{\cdot}6$ will be the period of one revolution."

Extract of a Letter from Mr. Lassell.

"I am happy to tell you that I have at length brought my polishing machine to do all that I ever hoped or purposed it should do. I had previously obtained very good surfaces with it, but they were obtained with some anxiety and uncertainty. I wished to be able to repolish a known good surface without hurting it, as well as to turn a bad one into a good one with certainty and expedition. This, I am happy to say, I can now do; and by certain rules, varying with the proportion of the focal length to the aperture, I can produce a parabolic surface which shall have the same focus in every part of its surface to the hundredth of an inch. The improvement in regularity of curve is not less than in the truth of its general form. I am about to make some experiments on the further shortening of focus, viz. a 12-inch metal of 7-feet focus, more, however, as a curiosity than for utility." *

FLORA.

CAMBRIDGE. Northumberland Equatoreal. (Prof. Challis.)

1848.	Greenwich M.T. h m s	R.A. h m s	Obs^d—Cal^d s	N.P.D. ° ′ ″	Obs^d—Cal^d ″	No. of Comps. R.A.	No. of Comps. N.P.D.	Star.
May 1	8 54 40·7	6 42 47·63	−0·20	65 46 2·1	−15·0	7	7	*a*
2	9 1 39·2	44 49·66	−0·66	46 45·7	17·6	6	6	*b*
3	8 43 47·9	46 49·96	−0·92	47 39·6	15·6	10	6	*b*
4	9 18 52·5	48 55·24	−0·85	48 43·3	13·2	6	6	*b*
5	8 56 24·2	50 56·15	−0·45	49 39·3	23·0	3	2	*c*
	9 11 29·2	57·83	−0·06	40·6	22·5	5	5	*d*
6	9 16 48·6	6 53 0·99	+0·11	65 51 5·0	−11·2	7	7	*e*

* Mr. Lassell is preparing an account of his polishing machine and methods of grinding specula, &c. to be laid before the Society.

1848.	Greenwich M.T. h m s	R.A. h m s	Obs^{d}—Cal^{d} s	N.P.D. ° ′ ″	Obs^{d}—Cal^{d} ″	No. of Comps. R.A.	No. of Comps. N.P.D.	Star.
May 8	10 6 57·5	6 57 10·18	−0·46	65 53 52·6	−12·2	1	1	*f*
	10 12 8·2	10·39	−0·69	50·7	14·4	4	4	*g*
9	9 31 53·1	6 59 10·31	−0·25	55 19·1	16·8	7	7	*h*
10	9 21 2·4	7 1 12·75	+0·11	57 7·6	7·4	6	6	*i*
11	9 7 5·7	3 14·84	+0·28	65 58 48·1	12·4	7	7	*j*
12	9 43 41·3	5 20·95	+0·09	66 0 49·1	7·6	5	5	*i*
13	9 47 57·3	7 23·96	−0·53	2 49·3	8·0	6	6	*k*
16	9 59 0·7	13 35·31	−0·26	9 24·7	14·4	6	6	*l*
17	9 39 8·6	15 36·58	−0·76	11 44·6	19·2	7	6	*l*
22	9 30 13·6	25 53·52	−0·79	25 45·3	7·0	6	5	*m*
23	9 28 55·8	27 57·47	−0·31	28 48·4	11·9	6	6	*m*
27	9 41 48·1	7 36 13·78	+0·62	66 42 25·3	− 4·6	4	4	*n*

"The comparisons are made with Mr. Hind's Ephemeris, *Monthly Notices*, vol. viii. No. 3.

"The observed places are corrected for refraction and parallax, and in the comparison with the calculated places aberration is taken into account.

"The following are the authorities for the adopted mean R.A. and N.P.D. of the stars:—

a = H.C. 13279
b = — 13313
c = — 13497
e = B.Z. 348: $6^{h}\,51^{m}\,45^{s}$
f = B.A.C. 2299
h = H.C. 13804
i = B.A.C. 2350
j = H.C. 13856
k = H.C. 14030
l = B.A.C. 2434
m = H.C. 14722
n = — 15112

"The adopted apparent places of the remaining two stars, which were determined by equatoreal comparisons, are the following:—

Star.	Apparent R.A. h m s	Apparent N.P.D. ° ′ ″	By comparison with
d	6 48 0·24	65 52 10·8	B.A.C. 2299
g	6 55 56·89	66 3 5·8	— —

"In the comparison of the Cambridge Equatoreal Observations of *Flora* in the *Monthly Notice*, No. 8, with Mr. Hind's Ephemeris, the correction for aberration was inadvertently applied with the wrong sign. When this mistake is corrected, the excesses of the observed above the calculated N.P.D. will stand as follows:—

	″		″		″		″
Feb. 16	− 8·2	March 3	− 8·6	March 28	−12·4	April 19	−16·0
	− 2·1	10	−11·9	29	+ 0·2		−15·2
	− 1·9	14	−18·2	April 1	− 6·1	28	− 9·2
17	+ 1·2	18	−21·0	6	− 8·7		−13·2
	−12·0	20	−14·2	10	+ 1·7	29	−10·0
18	−10·7		−17·9	14	−13·8		−12·6
27	− 7·6	21	− 8·2	17	−11·1		
28	− 3·8		−21·7		−10·4		

MAKERSTOUN. Equatoreal. (Sir T. Brisbane and Mr. J. Welsh.)

Date. 1848.	Greenwich Mean Time. h m s	R.A. h m s	N.P.D. ° ′ ″	Ephem. — Obs. R.A. s	Ephem. — Obs. N.P.D. ″	No. of Comps.	Star of Comparison.
Feb. 10	8 21 0	4 26 37·60	70 14 44·6	+0·68	−0·9	13	Taylor, 1598
	8 22 17	37·73	46·3	0·60	−2·9	8	B.A.C. 1417
11	7 42 17	27 38·50	70 8 47·3	0·58	−0·3	12	Taylor, 1598
17	9 22 43	34 29·21	69 32 23·5	0·75	−5·2	9	*a*
25	8 7 13	44 41·64	68 46 47·4	0·95	−0·3	1	B.A.C. 1551
	8 12 34	42·09	45·8	0·81	+0·1	2	*b*
26	7 5 40	4 46 0·86	68 41 29·5	0·71	1·4	10	*b*
	7 17 9	1·67	27·7	0·56	0·6	1	B.A.C. 1551
Mar. 13	9 26 1	5 10 32·82	...	(1·06)	...	9	*c*
	9 34 42	...	67 21 42·9	...	(2·9)	5	*c*
21	8 28 39	24 5·32	66 49 46·7	0·77	3·4	4	B.A.C. 1774
	8 34 26	5·68	46·3	0·83	2·9	9	*d*
24	7 54 26	29 20·54	39 16·2	0·74	4·9	10	B.A.C. 1774
28	8 55 1	...	26 27·7		0·5	4	*e*
	9 2 37	36 38·06	...	0·89	...	12	*e*
29	7 56 23	38 22·72	23 34·6	0·83	4·3	8	*e*
31	8 46 5	...	17 54·4	...	3·5	4	*f*
	9 0 1	42 8·48	...	0·95	...	7	*f*
April 1	8 17 40	43 57·03	...	0·84	...	11	*g*
	8 28 34	...	15 18·5	...	3·0	4	*g*
	8 35 57	...	17·7	..	3·0	4	*h*
	8 44 44	58·98	...	0·61	...	8	*h*
3	8 11 12	47 40·45	10 22·8	0·81	2·1	5	*i*
5	8 25 38	51 27·59	...	1·01	...	15	*k*
	8 27 4	...	66 5 44·0	...	5·8	5	*k*
8	9 7 34	5 57 13·78	65 59 38·3	1·19	5·7	1	*l*
10	9 1 53	...	56 7·8	...	7·1	5	*m*
	9 7 52	6 1 4·94	...	0·89	...	12	*m*
11	8 48 25	2 59·29	...	1·00	...	9	*m*
	8 55 0	...	54 33·0	...	7·3	5	*m*
14	8 26 35	...	50 26·0	...	9·8	4	B.A.C. 2011
	8 43 23	8 49·35	...	0·92	...	9	— —
17	8 47 4	...	47 17·4	...	10·9	1	— —
	9 0 2	...	18·0	...	9·8	2	*n*
	9 8 17	14 45·21	...	0·61	...	3	*n*
	9 13 1	45·59	...	0·92	...	2	B.A.C. 2011
29	9 20 17	...	65 44 58·9	...	+7·4	7	*o*
	9 25 45	6 38 46·77	...	+0·38	...	20	*o*
May 8	10 5 7	6 57 9·45	...	...	...	9	*p*
	10 27 0	...	54 1·8	...	...	2	*p*
10	10 11 38	...	65 57 7·4	...	...	4	*p*
	10 18 26	7 1 16·75	...	...	...	7	*p*

"The observations have been corrected for refraction and parallax. The corrections for aberration have been applied to Mr. Hind's Ephemeris (*Monthly Notices*, January 14), and the observed places compared with it.

"N.B. The observations of *Flora* at Makerstoun, printed in the *Monthly Notice* for March last, were not corrected for aberration previously to being compared with the Ephemeris.

"The mean places of the following stars have been obtained by comparison with known stars; when two or more comparisons have been obtained, they may be considered as tolerably correct. The place of the star *c* has been roughly *assumed* from the comparison with the planet.

Star.		Mag.	Mean R.A. 1848·0. h m s	Mean N.P.D. 1848·0. ° ′ ″	No. of Comps.	Star of Comparison.
a	H.C. 8844	7½	4 34 7·51	69 39 57·7	1	B.A.C. 1570
b	H.C. 9228,9		4 47 10·72	68 40 29·9	2	— 1551
c		8½	5 8 22·00::	67 20 35·0::		approximate.
d		8	5 24 20·00	66 46 19·1	3	B.A.C. 1774
e	H.C. 10844	8	5 36 42·62	66 19 17·0	5	— 1951
f		8	5 39 22·53	66 16 27·0	3	— 1951
g		9	5 43 46·65	66 18 58·7	3	— 1951
h		9	5 43 52·41	66 20 53·5	5	*g*
i		8½	5 46 43·04	66 9 26·7	1	B.A.C. 1951
k		8	5 52 52·02	66 4 44·0	3	— 2011
l	H.C. 11592	7½	5 58 54·02	66 7 32·2	1	— 2011
m	H.C. 11796	8	6 4 51·37	65 58 38·6	4	— 2011
n		8½	6 13 58·37	65 48 3·8	2	— 2011
o		8	6 38 41·83	65 41 22·6	3	— 2299
p		8	6 57 59·78:	65 52 13·3:	1	— 2299

All the observations were made by Mr. John Welsh.

"The star *m* has been observed by Taylor (No. 2360 of *Madras General Catalogue*); his R.A. reduced by precession alone to 1848·0 is $6^h\,4^m\,51^s{\cdot}80$, and, allowing the proper motion assigned by him, $6^h\,4^m\,52^s{\cdot}07$. There is another star about 2′ south of this, viz. Taylor, 2361 = Piazzi, vi. 14; two comparisons with B.A.C. 2011 give its R.A. for 1848·0, $6^h\,4^m\,51^s{\cdot}65$. Taylor's is $6^h\,4^m\,53^s{\cdot}22$; and allowing his proper motion, it is $6^h\,4^m\,53^s{\cdot}84$. If Taylor's R.A. is accurate, there seems to be something peculiar about the proper motions of these two stars. The place of the star *m*, both in R.A. and N.P.D., deduced from comparison with B.A.C. 2011, has been used (in the mean time) in preference to Taylor's; the N.P.D. agrees pretty well with Taylor."*

* The two stars mentioned by Mr. Welsh are H.C. 11796, 11797 = Piazzi, vi. 13, 14. The differences of right ascension between the two stars, according to these authorities, agree with that found by Mr. Welsh, so that there is no probability of any *relative* proper motion. There is an error of $+1^s$ in the right ascension of Taylor 2361. The star *m* must be reobserved to decide with respect to its correct right ascension.

NEPTUNE.

CAMBRIDGE. Meridian. (Professor Challis.)

1848.	Greenwich M.T. h m s	R.A. h m s	Obsd—Calcd. s	N.P.D. ° ′ ″	Obsd—Cald. ″
July 17	14 32 55	22 17 26·16	−1·04	101 20 2·5	+5·8
18	14 28 55	17 21·61	0·92	20 30·8	6·2
26	13 56 48	16 41·49	1·00	24 25·7	3·8
Aug. 1	32 40	16 8·89	0·81	27 39·9	4·7
2	28 38	16 2·99	1·05	28 14·3	5·9
5	16 33	15 45·72	1·05	29 54·0	4·9
7	8 29	15 33·97	1·07	31 2·0	4·5
9	13 0 26	15 22·12	1·04	32 10·4	3·9
10	12 56 24	15 15·99	1·17	32 48·3	7·1
17	28 10	14 33·42	1·02	36 51·2	3·5
19	20 6	14 20·84	1·21	38 1·5	2·7
21	12 1	14 8·21	1·40	39 15·5	5·5
22	7 59	14 2·14	1·25	39 51·3	5·6
23	12 3 57	13 55·85	1·29	40 26·2	4·9
24	11 59 55	13 49·60	1·31	41 2·6	5·7
29	39 44	13 18·38	1·37	43 59·0	4·7
Sept. 1	27 38	12 59·85	1·34	45 44·7	5·2
2	23 36	12 53·74	1·30	46 20·0	5·7
4	15 32	12 41·51	1·30	47 30·7	7·4
6	7 28	12 29·32	1·36	48 37·2	5·4
7	11 3 26	22 12 23·27	−1·40	101 49 11·6	+6·0

The N.P.D. have been corrected by −0″·27 for parallax.

DURHAM. Equatoreal. (Prof. Chevallier & Rev. R. A. Thompson.)

1848.	Greenwich M.T. h m s	R.A. h m s	Obsn—Ephs. s	N.P.D. ° ′ ″	Obsn—Ephs. ″	No. of Obs.	
Aug. 28	12 4 48·4	22 13 24·47	−1·40	101 43 22·3	+2·8	6	B.A.C. 7821
29	11 30 17·1	13 18·48	1·31	43 58·2	4·1	6	— —
31	11 55 40·7	13 6·00	1·25	45 11·5	6·3	7	— —
Sept. 1	12 11 33·0	12 59·59	1·41	45 42·6	2·0	3	— —
6	9 51 13·8	12 29·59	1·41	48 34·6	4·6	2	— —
8	11 36 44·1			49 43·2	3·2	2	— —
12	10 1 22·2	11 53·67	1·65	51 57·2	6·9	7	— —
	12 8 40·8	53·15	1·65	58·9	5·7	6	B.A.C. 7740
14	10 24 48·7	11 41·89	1·78	53 0·3	4·9	1	— —
	10 41 54·0	42·05	1·59	2·7	6·9	Meridian, faint	
16	10 33 51·9	22 11 30·68	−1·61	101 54 7·0	+8·1	Meridian, faint	

Corrections have been applied for parallax, and the results are compared with Mr. Adams' Ephemeris.

Mean Places of Stars, June 1, 1848, from Meridian Observations, Durham.

	R.A.	No. of Obs.	N.P.D.	No. of Obs.
	h m s		° ′ ″	
B.A.C. 7740	22 4 20·26	2	101 48 46·8	1
B.A.C. 7821	22 18 36·85	2	101 59 54·5	2

Nearly agreeing with B.A.C. in north polar distance. The right ascensions of the catalogue seem to be about $0^s.5$ too large.

Elements.

Mr. Sears C. Walker gives the following elements of *Neptune* as the latest results of his investigations:—

π	=	47 12 6·50	M. Eq. Jan. 1, 1847
Ω	=	130 4 20·81	M. Eq. Jan. 1, 1847
i	=	1 46 58·97	
e	=	0·00871946	
μ	=	21″·55448	
M	=	328°32′44″·20	Green^h M. Noon, Jan. 1, 1847
T	=	164·6181	Tropical Years.

Professor Peirce has computed the perturbations of *Uranus* by *Neptune*, taking an approximate value of his elements and using the mass which is given by Lassell's Satellite. He has stated the results of a comparison between the observed and calculated places of *Uranus*, from 1690 downwards, using these perturbations, and finds them satisfactory throughout.

"It will be perceived," he says, "from this table, that the motions of *Uranus* contain no indications of another external planet, or of any error in the mass of *Saturn*. *Neptune* stands, therefore, in direct opposition to the proposition that no planet placed at a less mean distance than 35 times the distance of the earth from the sun, can possibly account for the observed irregularities in the motion of *Uranus* to within 5″ of arc for modern observations and 10″ for ancient ones.* The table is computed from Walker's last elements of *Neptune* as a basis."

* This alludes to the limit 35·04 which M. Le Verrier assigned as the lowest value of the mean distance of the planet exterior to *Uranus*. There has been a good deal of discussion of late upon this point, which may be found in the recent numbers of the *Comptes Rendus* and in the *Athenæum* journal. Professor Peirce has given in his table the elements of the exterior planet as found by Mr. Adams on two hypotheses of mean distance, and he seems to have concluded that these contained the *final results* obtained by Mr. Adams. This is not the case, and it is worth while to refer particularly to Mr. Adams' letter of Sept. 2, 1846 (*Monthly Notices*, vol. vii. p. 137). Having obtained elements of the disturbing planet on two hypotheses of mean distance, Mr. Adams examines how far the observations of *Uranus* correspond to the two hypotheses, and concludes, that from 1712 almost to 1840 the observations are equally well represented on either hypothesis, but that, towards the end of that time, and later, the errors begin to increase, until, in 1843, they are very sensible; being, moreover, always larger in the hypothesis of the larger mean distance. He infers (p. 139), "that the agreement between theory and observation would be rendered very close by assuming the ratio of the mean distances of *Uranus* and its disturbing planet to be as 0·57

HEBE.

CAMBRIDGE. Northumberland Equatoreal. (Prof. Challis.)

1848.	Greenwich M.T. Apparent R.A. h m s		Log. $\frac{p}{P}$	Apparent N.P.D. ° ′ ″		Log. $\frac{q}{P}$	No. of Comps. R.A.	No. of Comps. N.P.D.	Star.
Aug. 22	14 9 22·2	5 12 45·17	−8·600	81 26	5·8	−9·877	1	1	*a*
	14 31 10·0	47·39	8·583		8·9	9·872	10	6	*b*
	15 18 0·7	50·62	8·542		5·1	9·862	2	2	*c*
24	13 31 51·4	16 18·79	8·614	81 30	9·9	9·885	7	6	*d*
Sept. 4	14 57 54·7	35 13·77	8·529	82 0	27·3	9·863	8	6	*e*
6	14 5 14·9	5 38 23·74	8·580	82 7	6·4	9·873	4	4	*e*
	14 17 16·1	25·15	−8·569		8·6	−9·871	2	2	*f*

No correction has been applied for parallax. (See note to *Metis*.) The following are the adopted mean places of the stars.

	Mean R.A. 1848·0 h m s	Mean N.P.D. 1848·0 ° ′ ″	Star.
a =	5 12 32·14	81 27 59·6	B.A.C. 1656
b =	5 13 27·09	81 43 35·2	Not in catalogues
c =	5 9 52·05	80 57 2·0	Bessel, v. 219
d =	5 16 24·09	81 38 29·8	— v. 375
e =	5 35 26·37	82 5 55·9	H.C. 10816
f =	5 39 40·35	82 5 56·6	Bessel, v. 1015

to 1·0 :" *i. e.* the semi-axis major of the exterior planet to be 33·6 nearly. As a consequence of this change in the semi-axis major he also infers, " that the excentricity of the exterior planet would be very small," and it is evident that the mass would also be much diminished. In these respects Mr. Adams' theoretical elements make a notable approach to the elements of *Neptune*. He infers, too, " that the corresponding mean longitude, 1st October, 1846, would be about 315° 20′," which is wide of the truth, for as his mean distance assigns no sensible value to the excentricity, his mean and true heliocentric longitudes cannot differ widely, whence the error in the assigned place of the planet would be nearly 10° (See Mr. Adams' remarks, *Nautical Almanac*, 1851, Appendix, p. 291).

On looking over Mr. Adams' solution, we find that his first determination is of the *difference of mean longitude between Uranus and his disturbing planet in* 1810·328. On his first hypothesis of $\frac{a}{a'} = 0{\cdot}5$ he finds the longitude of the disturbing planet = 269° 25′, on his second hypothesis of $\frac{a}{a'} = 0{\cdot}515$ he finds the longitude of the disturbing planet = 264° 50′, whence it would follow (if simple proportion can be trusted in such a case) that for $\frac{a}{a'} = 0{\cdot}57$ the resulting mean longitude = 248° 1′ nearly, *i.e.* at 1810·328. Now this was, very nearly, the longitude of *Neptune* at that time, the error in 1846 being almost wholly due to the erroneous mean motion in bringing up the mean longitude to 1846.

It will be seen, on carefully considering the tables in *Nautical Almanac*, 1851, Appendix, pp. 289, 290, that the observations from 1712 to 1840 can be equally well satisfied on different hypotheses of the mean distance of the disturbing planet, and that, from the nature of the case, the changes in the perturbations resulting from a difference in the assumed mean distance are compensated by corresponding changes in the elements of *Uranus* and the disturbing planet. Within what limits this general statement is true must be left to competent inquirers.

These places were derived from the Catalogues, with the exception of those of *a* and *b*, which were determined by equatoreal comparisons with 14 *Orionis*, the place of the former star being given only approximately in the British Association Catalogue.

HAMBURG. Equatoreal. (M. Rümker.)

1848.	Hamburg M.T. h m s	R.A. ° ′ ″	Dec. ° ′ ″
Sept. 4	14 28 9·4	83 47 22·9	+7 59 51·4
5	14 36 55·9	84 11 19·4	56 29·9
6	13 58 33·7	35 20·7	52 55·3
7	14 23 11·7	84 59 25·5	49 26·2
9	13 58 53·3	85 46 6·6	42 5·8
12	14 35 57·4	86 55 8·0	30 11·6
14	13 8 23·0	87 38 0·5	22 31·1
15	15 46 48·8	88 0 47·0	7 17 34·1::
20	13 29 28·8	89 44 35·2	6 56 12·0
21	13 12 58·0	90 4 9·5	51 51·1
22	13 26 41·3	90 24 2·0	47 3·4
23	12 55 57·6	91 42 54·5	42 13·4
24	12 55 40·4	91 1 51·8	+6 37 51·9

IRIS.

CAMBRIDGE. Northumberland Equatoreal. (Prof. Challis.)

1848.	Green. M.T. h m s	Appt R.A. h m s	Log. $\frac{p}{P}$	Appt N.P.D. ° ′ ″	Log. $\frac{q}{P}$	No. of Comps.	Star.
Aug. 22	15 42 23·4	7 35 26·11	−8·641	69 21 57·1	−9·859	3	*a*
Sept. 2	15 3 50·9	7 59 22·51	8·637	70 43 1·5	9·874	4	*b*
6	14 52 9·0	8 7 45·71	8·635	71 15 8·9	9·877	3	*c*
	15 19 20·5	48·41	−8·635	17·3	−9·863	4	*d*

Parallax has not been applied. The stars and authorities for their places are the following,—

a = B.A.C. 2556 *b* = B.A.C. 2683 *c* = B.A.C. 2759 *d* = H.C. 16245

The results of comparison with Mr. Hind's Ephemeris (*Monthly Notice*, No. 8), after correcting for parallax and aberration, are as follows :—

	R.A. Obsd—Cald s	N.P.D. Obsd—Cald ″
August 22	− 7·92	−27·5
Sept. 2	8·68	39·2
6	10·15	44·8
	− 9·81	−45·6

HAMBURG. Equatoreal. (M. Rümker.)

1848.	Hamburg M.T. h m s	R.A. ° ′ ″	Dec. ° ′ ″
Sept. 23	14 34 54·2	130 22 23·8	+16 15 35·6

SOUTH VILLA. Equatoreal. (MM. Bishop and Hind.)

1848.	Greenwich M.T. h m s	R.A. ° ′ ″	Dec. ° ′ ″
August 7	14 50 57	105 11 31·9	+22 8 33·3
22	14 30 26	113 49 48·8	+20 38 24·0

Mr. Hind says, "My ephemeris is in error.

	$\Delta\alpha\cos\delta$ ′ ″	$\Delta\delta$ ″
August 7	+1 24·9	−19·3
22	+1 51·2	−21·7

The planet shone as a star of the 11–12th magnitude.

ASTRÆA.

CAMBRIDGE. Meridian. (Professor Challis.)

1848.	Greenwich M.T. h m s	R.A. h m s	No. of Wires.	N.P.D. ° ′ ″	Log. $\frac{q}{P}$
Aug. 9	12 15 55·3	21 30 44·63	4	104 26 27·8	−9·961
17	11 37 30·9			105 10 51·9	9·964
21	18 27·5	20 25·83	4	32 34·0	9·965
22	13 41·3	19 35·42	3	37 44·8	9·965
23	8 54·9	18 44·79	4	105 42 49·9	−9·966
24	11 4 11·7	21 17 57·36	5		

Northumberland Equatoreal.

1848.	Greenwich M.T. h m s	Apparent R.A. h m s	Log. $\frac{p}{P}$	Apparent N.P.D. ° ′ ″	Log. $\frac{q}{P}$	No. of Comps. R.A.	No. of Comps. N.P.D.	Star.
Aug. 9	11 14 8·5	21 30 42·43	−8·049	104 26 27·5	−9·959	2	2	*a*
	11 23 24·0	42·21	−7·982	19·8	9·959	12	11	*b*
17	12 1 1·3	23 46·65	+7·634	105 11 8·6	9·963	6	6	*c*
19	12 51 56·6	22 2·72	8·182	22 10·6	9·959	7	7	*d*
24	12 47 14·2	17 54·36	8·267	105 48 33·1	9·958	5	8	*e*
Sept. 2	10 55 24·3	21 11 11·73	7·763	106 31 13·7	9·967	5	3	*f*
	11 4 47·2	11·42	+7·898	14·2	−9·966	4	4	*g*

Corrections for parallax have not been applied either to these or to the meridian observations. The letters P, *p*, *q*, have the signification explained under the observations of *Metis*.

The following adopted mean R.A. and N.P.D. of the comparison stars were determined by meridian observations, with the exception of the N.P.D. of the star *c*, which was taken from Bessel.

	Mean R.A. 1848·0. h m s	Mean N.P.D. 1848·0. ° ′ ″	Designation of Star.
a	21 33 16·62	104 43 22·0	42 Capricorni
b	21 29 58·20	104 12 49·4	Bessel xxi. 716
c	21 22 20·49	104 57 15·4	— xxi. 522
d	21 20 28·50	105 28 49·9	Not in catalogues
e	21 18 4·24	105 53 57·8	H.C. 41647
f	21 10 47·97	106 48 51·0	B.A.C. 7396
g	21 9 25·30	106 31 21·7	H.C. 41317

HAMBURG. Equatoreal. (M. Rümker.)

1848.	Hamburg M.T. m h s	R.A. m h s	Decl. ° ′ ″	No. of Obs.
July 27	13 54 57·8	325 19 55·5	−13 15 14·3	5
29	12 20 38·2	324 57 25·4	25 46·7	11
30	11 35 28·1	46 4·1	30 48·3	20
Aug. 1	11 28 20·6	21 56·3	41 38·1	5
2	11 57 55·3	324 9 28·2	47 5·8	13
3	10 53 36·0	323 57 45·9	13 52 21·5	4
6	10 19 29·7	20 19·4	14 9 9·2	6
7	10 46 28·7	323 7 6·3	14 46·1	16
9	12 51 51·9	322 40 7·0	14 26 31·2	6
18	9 12 59·1	320 45 37·4	15 15 53·4 ::	
19	9 58 54·7	320 32 44·6	21 13·6	6
25	9 24 15·5	319 18 39·2	15 42 45·0	18
28	10 49 10·4	318 43 4·2	16 7 55·0	10
30	9 55 40·3	21 5·8	27 25·2	5
31	9 34 55·6	318 10 6·5	21 48·2	15
Sept. 4	9 15 57·0	317 28 43·0	39 11·3	20
5	9 53 56·5	317 18 50·5	−16 43 35·9	11

METIS.

CAMBRIDGE. Northumberland Equatoreal. (Prof. Challis.)

1848.	Greenwich M.T. h m s	Appt R.A. h m s	Log. $\frac{p}{P}$	Appt N.P.D. ° ′ ″	Log. $\frac{q}{P}$	No. of Comps. R.A.	No. of Comps. N.P.D.	Star.
June 7	11 49 31·8	14 20 17·80	+8·418	101 22 41·2	−9·937	6	6	*a*
13	12 7 0·6	18 4·12	8·504	26 46·2	9·929	6	6	*b*
22	10 54 0·3	16 29·67	8·435	101 41 8·8	9·937	6	6	*c*
July 5	10 59 17·1	17 49·83	8·534	102 17 27·7	9·926	1	1	*d*
	11 12 43·6	50·06	8·549	43·2	9·923	7	7	*e*
6	10 9 40·0	18 5·68	8·450	21 3·2	9·936	7	8	*e*
12	9 51 55·2	20 11·96	8·464	43 59·4	9·937	9	8	*f*
13	10 23 34·6	20 38·12	8·522	48 13·5	9·929	12	13	*f*
15	10 7 3·8	21 32·73	8·509	102 56 41·6	9·932	7	7	*f*
27	9 44 30·4	28 22·10	8·537	103 53 57·9	9·929	5	5	*g*
Aug. 4	9 21 36·9	14 34 55·43	8·542	104 36 55·8	9·929	5	5	*h*
	9 30 9·2	56·36	+8·553	54·4	−9·927	1	1	*i*

" P is the equatoreal horizontal parallax, and p, q, are the corrections for parallax which are yet to be added to the apparent R.A. and N.P.D., the former expressed in seconds of time and the other in seconds of space. Hence the logarithms of p and q will be obtained by adding to the logarithms given in the above table,

the logarithms of the equatoreal horizontal parallax for the respective times of observation.

The following are the reference-stars, the adopted places of which are taken from the catalogues cited:—

a	Bessel xiv. 424	*d*	Bessel xiv. 278	*g*	Bessel xiv. 512
b	B.A.C. 4772	*e*	— xiv. 280	*h*	— xiv. 596
c	Bessel xiv. 259	*f*	B.A.C. 4787	*i*	— xiv. 701

PETERSEN'S COMET.

On the 7th of August, about 14^h, Dr. Petersen discovered a telescopic comet in *Auriga*. "The comet was small, but pretty well defined, bright and good to observe."

Observations.

ALTONA. Equatoreal. (Prof. Schumacher & Dr. Petersen.)

1848.	Altona M.T. h m s	R.A. h m s	Decl. ° ′ ″
August 7	14 32 16	6 14 57·2	
	14 46 13	15 0·3	+41 18 46::
10	13 20 43	31 22·3	38 49 0::
11	13 46 40	6 37 14·86	+37 51 50·8

HAMBURG. Equatoreal. (M. Rümker.)

1848.	Hamburg M.T. h m s	R.A. ° ′ ″	Decl. ° ′ ″	No. of Obs.
August 11	13 45 21·2	99 18 27·8	+37 51 42·8	8
13	14 6 41·7	102 21 35·6	35 43 55·4	2
18	14 0 6·0	110 39 45·6	29 5 6·6	10
19	14 36 59·8	112 30 57·6	27 26 10·0	9
22	14 54 54·5	118 17 38·4	22 0 5·1	9
23	15 18 31·4	120 22 6·5	19 57 56·5	5
25	15 26 46·1	124 38 55·6	+15 39 58·1	1

The weather on the 25th was very unfavourable.

The following elements have been computed by M. Sonntag from Altona observations of August 11, 18, and 25, and by M. George Rümker from the Hamburg Observations of August 11, 19, and 23:—

	M. Sonntag.	M. G. Rümker.
	Per. Pass. Sept. 8·07800, Berlin M.T.	Sept. 8·056005, Greenwich M.T.
	° ′ ″	° ′ ″
Ω	212 8 35 } M. Eq.	211 34 35·7 } App. Eq.
π	311 4 16 } Aug. 20.	310 34 36·1 } Aug. 19.
i	85 59 33	84 28 22·0
Log. *q*....	9·504496	9·50484748
	Motion Retrograde.	Motion Retrograde.

Comparison of Observations with an Ephemeris by M. George Rümker, founded upon his Elements.

Place of Observn	Augt	Greenw. M.T. h m s	R.A. ° ′ ″	Obsd—Cald. ″	Decl. ° ′ ″	Obsd—Cald. ″
Altona	10	12 40 56·6	97 49 59·2::		+38 49 45	—13
Hamburg	11	13 5 27·2	99 18 27·8	— 1·1	37 51 42·0	+ 0·9
Altona		13 6 57·9	18 40·0	+ 5·5	51 50·8	+13·8
Hamburg	13	13 26 47·7	102 21 35·6	+ 6·2	35 43 55·8	— 4·1
Altona	18	13 4 48·0	110 38 33·0	— 4·2	29 5 58·5	+ 5·1
Hamburg.....		13 20 12·0	39 45·6	— 0·2	5 6·6	+13·1
Hamburg G. R.		13 35 30·7	40 45·0	— 8·7	4 6·6	+12·5
Altona		13 52 6·9	42 4·3	— 3·6	2 50·9	+ 1·6
Berlin		14 0 0·1	42 8·5	—34·5	2 19·9	+ 0·4
Hamburg	19	13 57 5·8	112 30 57·6	— 2·6	27 26 10·0	— 1·4
Altona.....		14 7 15·9	31 40·8	— 5·9		
Altona		14 15 13·7			24 55·8	— 0·4
Berlin		14 17 14·6	32 16·8	—15·3	24 48·6	+ 1·0
Regent's Park...		14 18 31	32 23·0	—15·7	24 39·6	— 2·8
Hamburg, G. R.		14 37 45·0	34 0·3	— 6·2	23 31·9	+ 8·4
Hamburg	22	14 15 0·5	118 17 38·4	—11·2	22 0 5·1	— 2·0
Regent's Park...		14 58 29·0	21 39·6	+11·6	21 56 16·3	—19·1
Hamburg	23	14 38 37·4	120 22 6·5	+ 0·0	19 57 56·5	— 0·0
Altona		14 49 38·9	23 7·7	+ 4·1	56 44·8	—13·5
Hamburg	25	14 46 52·0	124 38 55·6	+ 2·8	+15 39 58·0::	—23·0
Altona		14 58 35·9	40 12·7	+15·0	38 43·9::	—33·8

ENCKE'S COMET.

An ephemeris of Encke's Comet for Greenwich mean midnight has been published by Lieut. Stratford, copies of which have been distributed very freely. Any Fellow of the Society can be supplied with a copy on applying to Mr. Williams.

CAMBRIDGE. Northumberland Equatoreal. (Prof. Challis.)

1848.	Greenwich M.T. h m s	R.A. h m s	Obsd—Cald. s	N.P.D. ° ′ ″	Obsd—Cald. ″	No. of Comps. R.A.	No. of Comps. N.P.D.	Star.
Sept. 2	13 30 6·5	3 32 16·54	+4·47	55 59 37·8	—28·8	6	5	*a*
4	12 14 39·4	37 6·06	7·51	55 15 21·9	26·3	2	2	*b*
	12 34 8·1	6·69	6·10	14 57·8	31·2	2	2	*c*
	13 36 52·4	15·20	8·02	13 48·9	38·2	6	4	*d*
6	12 32 47·1	3 42 17·53	5·94	54 25 26·7	96·3	3	3	*e*
	12 49 38·8	20·91	+7·43	18·3	—87·3	2	2	*f*

The observations are corrected for parallax, and compared with the ephemeris published by Lieut. Stratford. The authorities for the places of the known stars are the following :—

a = B.A.C. 1132 *b* = Piazzi, iii. 194 *c* = H.C. 7016 *f* = B.A.C. 1228

The assumed apparent R.A. and N.P.D. of the stars *d* and *e*, determined by equatoreal comparisons with *b* and *f* respectively, are,—

	h m s	° ′ ″
d	3 36 21·12	55 15 58·0
e	3 46 55·27	54 25 59·7

The comet had the appearance of an extremely faint nebulosity of very large diameter, and its point of maximum brightness was so difficult to fix upon, that the observations are entitled to very little weight. The magnifying power employed was 120.

SOUTH VILLA. Equatoreal. (MM. Bishop & Hind.)

1848.	Greenwich M.T. h m s	R.A. h m s	Decl. ° ′ ″
Sept. 3	15 7 49	3 34 53·5	+34 24 27
4	13 49 4	3 37 13·5	+34 46 10

Professor Colla saw the comet at Parma on Sept. 20th, with an excellent telescope of Lerebours, 4 French inches aperture. "It appeared like a faint round nebulosity, the light condensing towards the centre, with traces of scintillation throughout the mass. It was just visible in a telescope by Gilbert of 2·5 inches aperture."

It was seen at Hartwell on Sept. 22d and 25th: "it was so faint as to require a 6-inch object-glass and a practised eye. It appeared in a dull nebulous spot, about 3′ in diameter, rather oblong, a little condensed towards the centre, and shaded off indefinitely at the edge." The corrections to be applied to Lieut. Stratford's ephemeris to satisfy the Hartwell Observations are,—

R.A. + 26^s Decl. − 1′ 28″.

Professor Challis' method of correcting Equatoreal Observations for Refraction.

The corrections for refraction in differential equatoreal observations made at the Cambridge Observatory, when the hour-angles for the star of comparison and object compared are the same, are calculated by the formulæ given in p. 188, vol. i. of Bessel's *Astronomische Untersuchungen*. In the triangle of which the angular points are at P the pole of the heavens, Z the zenith of the observer, and S the place of the star; draw from Z a perpendicular ZQ on PS. Let $d' - d$ be the apparent excess of the north polar distance of the object compared, above that of the star of comparison, and Δ the true north polar distance of the latter, or, more correctly, the mean of the north polar distance of the two objects; and let $\mu' - \mu$ be the excess of right ascension given by the difference of times of transit. Then

Correction applied to $d' - d = \varkappa (d' - d) \sec^2 (\Delta - PQ)$

Correction applied to $\mu' - \mu = \varkappa (d' - d) \sec^2 (\Delta - PQ) \cdot \frac{\tan QZ}{15} \cdot \frac{\cos (2\Delta - PQ)}{\sin^2 \Delta}$

For calculating $\varkappa$, which depends both on the zenith distance and on the barometer and thermometer readings, the following empirical formula is sufficiently accurate and of ready computation:—

$$\text{Log } \varkappa = \text{Log } k + 0{\cdot}015\,\text{B} + 0{\cdot}001\,(100^\circ - \text{T}),$$

where Log k is Log α'' (in Bessel's Table, pp. 198 and 199 of the work already cited) diminished by the constant 0·4957, B is the barometer reading in English inches, and T is the thermometer reading in degrees of Fahrenheit (Bessel's Log α'' takes account approximately of the variation depending on zenith distance of the factor A in the expression, A tan zen. dist. for the total refraction). To select the proper value of Log k, the argument zenith distance (z) is first obtained by the formula, sec z = sec Q Z sec (Δ — P Q). The calculations are much facilitated by the formation of two tables; one containing the values of P Q, Log sec Q Z, and Log $\frac{\tan \text{Q Z}}{15}$, for every ten minutes of hour-angle from 0^h to 6^h, whence, by interpolation, and by proper attention to changes of sign, the values may be obtained for any given hour-angle; the other, a table of values of Log k, in which the argument is z, or, which is preferable, Log sec z, the difference between the consecutive logarithms being 0·01.

In an instance in which the apparent difference of north polar distance was 32′·1, the hour-angle $3^h\,49^m{\cdot}7$, and the zenith distance 82°·3, the corrections calculated by the above approximate formulæ were 18″·12 and $0^s{\cdot}769$. By exact calculation they were found to be 18″·27 and $0^s{\cdot}762$.

When differences of right ascension and north polar distance are measured while the equatoreal is carried by clock-movement (which is sometimes done with the Northumberland equatoreal), it is necessary to compute exactly the total refractions in right ascension and north polar distance of each object, no other method appearing to possess sufficient accuracy.

Extract of a Letter from Mr. Alfred Weld, Director of the Observatory at Stoneyhurst College.

"On September 20, I observed a large spot on the sun with our equatoreal, and found that it consisted of several dark nuclei enveloped in one large penumbra. On the 21st, I made several observations, from which I deduced the following values of the angles subtended by the spot and nucleus:—

Greatest diameter of spot	2′ 41″·1
——— nucleus	1 7·2
Equatoreal diameter of spot	2 14·1
——— nucleus	0 49·2
Meridian diameter of spot.....	2 14·1

"The spot was distinctly visible to the naked eye before sunset."

By comparisons with δ *Ophiuchi*, *Spica*, and *Antares*, Mr. Weld found the declination of Mr. Hind's changing star to be $-12^{\circ}\ 37'\ 15''$.

NOTICE OF THE PRINCIPAL ENGLISH OBSERVATORIES.

EXTRACTED FROM OFFICIAL OR DIRECT SOURCES.

It has been thought advisable to insert a brief account of our principal Observatories in the *Monthly Notices*, as, notwithstanding the great liberality with which their publications are distributed, and their observations communicated, many members may not be sufficiently acquainted with their condition. Two British Observatories only, are, properly speaking, public — those of Greenwich and Edinburgh. The Observatory of Oxford was built and is supported by a bequest under Dr. Radcliffe's will: it is under the control of private trustees. The Cambridge Observatory was erected principally by private subscription, and is supported in part by the funds of a professorship founded by Dr. Plume, but mainly out of the University chest. The Radcliffe observer makes an annual report to his trustees; and Visitors appointed by the Cambridge Senate draw up yearly a statement to be laid before that body. Since the appointment of Mr. Airy to the Royal Observatory, a minute Report of all proceedings and changes in that establishment is read to the Board of Visitors at the Annual Visitation in June.

Greenwich.

It has been mentioned in former numbers that the Meridional Instruments at Greenwich are deficient in optical power, and that the Astronomer Royal proposed to replace the Mural Circle and Transit by a single instrument, viz. a Transit Circle, which is to be erected on the site of the present circle-room. In his Report to the Visitors, Mr. Airy says:—

"An object-glass of 8 inches clear aperture and 11 feet 6 inches focal length having been placed in my hands by Mr. Simms, I carefully examined it. I found that it shewed some objects not of the closest class (as ε *Boötis* and ζ *Cancri*) better, I think, than I had seen them before: that it separated η *Coronæ*; that it did not separate γ *Coronæ* (which, having witnessed the difficulty of that star in the great Pulkowa refractor, I was prepared to expect); and that it dispersed light no more than the best object-glasses usually do. At my recommendation, therefore, this object-glass was purchased by the Lords Commissioners of the Admiralty, at the price of 275*l*. I have now to explain the form in which I propose to mount it. No verbal description, probably, can dis-

pense with reference to the model,* and I will therefore confine myself to the leading points. I propose to mount it as a Transit Circle, its Ys bearing solidly on the piers far from their edges, and having no adjustments; the axis carrying two nearly similar circles on the East and West arms, one for clamping, the other for the divisions. I propose that the clamps have no tangent-screw, the bisection being in all cases effected by the micrometer in the field of view of the telescope. I propose that the divisions be illuminated by a single lamp in the prolongation of the axis, without reflectors; and that the microscopes be in a conical surface, passing through one pier, the eye-ends being in a circle of two feet diameter; and that the divisions be cut upon a limb of metal which is so bevelled on the circle that the light of the lamp will be reflected up the microscopes. Several microscopes to be permanently mounted, in positions proper for ascertaining with the utmost exactness the errors of division. Microscopes to be mounted for ascertaining the laws of movement of points on the ends of the pivots. The instrument never to be reversed; but an apparatus to be provided for raising it so far that a collimating telescope firmly fixed on a solid pier on the north side, and one on the south side, can be adjusted on each other; then when the instrument is dropped into its usual place, the error of collimation and the flexure will be determined without reversion, by observation of the two collimators. No spirit-level or equivalent instrument to be used, but the error of level to be determined by observation of the image of the wires by reflexion in a trough of mercury. A parallel-motion apparatus to be used for carrying the trough, and a peculiar arrangement for facilitating the process of cleaning the mercury. In regard to the material, I propose that the whole be made of cast-iron, the axis being in two parts (which enables the founder to make the pivots of hard chilled iron, while the rest is of soft iron), each end of the telescope being in one part, and each of the two circles being cast in one piece. An instrument thus constructed would, probably, be more accurate for right ascensions than the present transit, in so far as the frequent observation of the well-mounted collimators would add to the knowledge of its azimuthal error; and perhaps more accurate for zenith distances than Troughton's Circle, in so far as the circle is in a state of less strain, while its construction possesses greater firmness. But the reasons for recommending it, as is known to the Visitors, are, the power of carrying a larger object-glass, and the enabling one observer to complete the observation of the two elements."

The observations in Polar Distance were made with Jones's Cape Circle, until Troughton's Circle was erected in another apartment, where it is and will be used until the circle-room is rebuilt and

* A small model of the proposed transit circle was exhibited at the Visitation in June; and the Astronomer Royal, having obtained the consent of the Government, is proceeding with the construction of the instrument. A full-sized model has been made and approved. The circle room is rebuilding.

furnished. The Transit will not be disturbed till the new instrument is at work.

The Zenith Tube has been taken down. It was proposed by some of the Visitors that it should be erected in another and less objectionable position than that which it formerly occupied, and a new site was pointed out by the Astronomer Royal. Mr. Airy, however, greatly prefers a different construction, if a continuous series of observations of γ *Draconis* be required. The principle of this construction, which is singularly simple, is thus described by Mr. Airy:—

"Let the micrometer be placed close to the object-glass, the frame of the micrometer being firmly connected with the object-glass cell, and a reflecting eye-piece being used with no material tube passing over the object-glass; and let a basin of quicksilver be placed below the object-glass, but in no mechanical connexion with it, at a distance rather greater than half the focal length of the object-glass, so that an image of the star is formed on the wires after the rays are reflected from the mercury. Such an instrument would at least be free from all uncertainties of twist of plumb-line, viscosity of water, attachment of upper plumb-line microscope, attachment of lower plumb-line microscope, and the observations connected with them; and might be expected, as a result of this extreme simplicity, to give accurate results."

The Astronomer Royal was recommended by the Board of Visitors to take the necessary steps for procuring a Zenith instrument on the principle described, and he has already printed and distributed an account of the construction which he proposes to adopt, with explanatory drawings. There seems scarcely any limit to the power and probable accuracy of such a Zenith tube, and as the mounting is exceedingly cheap and simple, it will most likely come into general use, especially for nice determinations of latitude.

It will be remembered that an Altitude and Azimuth Instrument, made after Mr. Airy's designs by Messrs. Ransome and May, and Messrs. Troughton and Simms, has recently been added to the Royal Observatory, for the express purpose of observing the moon. Mr. Airy says:—

"The Altitude and Azimuth Instrument having now been in use for an entire year, I am able to give some account of its success or failure as a mechanical arrangement. The first subject for remark is the steadiness of support of the upper pivot, which is held in its place, as the Visitors will remember, by a frame of bars whose arrangement in every part is triangular. The steadiness is perfect. In the first observations, the levels were read before and after the telescopic observation, but it was very soon found that this caution was entirely unnecessary. The next point is the steadiness in the position of the horizontal axis of the vertical circle relatively to the vertical revolving-frame, and generally the steadiness of the constants of instrumental errors. For some time the constants were so unsteady as to give me great trouble. Several observations of stars were absolutely rejected. In the month of

July, after careful consideration of the discordances, I came to the conclusion that there was a wandering of the horizontal pivots in their Ys, caused probably by the counterpoises: the counterpoises were therefore diminished by one-third part, and since that time the constants of instrumental error have been steady, and not a single observation has been rejected. The next circumstance which gave me trouble was the uncertainty in the scale-values of some of the long levels. The singular good fortune of having four parallel levels upon the instrument, which are always read, enabled me to compare the proportion of the scale-values in actual use to the scale-values determined before mounting. These were very discordant. I became at length persuaded that this was caused by the very defective construction usually adopted in the mounting of English levels; and in the autumn I applied to the two longest levels the construction with which I had become familiar in Germany and Russia, in which the glass tube of the level is supported in Ys: since that time the levels have been fairly accordant. Another contrivance extensively applied to German levels, namely, the covering by glass shades, has also been applied here. A difficulty which can be surmounted only by constant care has sometimes presented itself, namely, that when the dome is opened very shortly before observation, the changes of readings of the upper and lower levels do not exactly correspond. Lastly, when the best values of instrumental errors of every kind are applied, the accuracy of every part of observation, of calculation and application of instrumental errors, and of tabular calculation, is checked by the determinations of the zero of azimuth. These determinations are sufficiently steady in any one evening, or, perhaps, in groups of several evenings; but they are not steady from time to time, the variation amounting to three or four seconds of arc. Whether this arises from a twist of the brick pier, or from a twist of the piers of the Transit Instrument (the times being obtained from the transit-clock), or from a change in the observer's personal equation, I cannot tell. The substitution of improved meridional instruments for those now in use will enable me to remove one of these conjectural causes.

"I have spoken hitherto solely with respect to the azimuthal observations, in which alone, from the first, I anticipated any difficulty. The zenith distance observations have never given the smallest trouble.

"The accuracy of the results, as estimated by the observation of stars, is somewhat less than that of the Mural Circle, perhaps nearly in the degree which might be expected in circles whose diameter is half that of the Mural Circle.

"For observations with the Altitude and Azimuth Instrument, the following rule is laid down. The moon is to be observed if visible, and the observer is bound to watch if necessary while the moon is above the horizon, and the sun is not more than an hour above the horizon. One azimuth and one altitude are to be observed, and if possible, two azimuths and two altitudes in re-

versed positions of the instrument: and if the night is fine, a low star and a high star are to be observed in azimuth, both in reversed positions of the instrument, and one star in altitude, in reversed positions. Thus a complete set includes ten observations. These rules have been followed carefully during the thirteen lunations intervening between 1847, May 15, and 1848, May 30; and I am now able to give a comparison of the number of days of observation of the moon with the Altitude and Azimuth Instrument and with the Meridional Instruments. With the Altitude and Azimuth Instrument no days are included except both altitudes and azimuths are observed; and with the Meridional Instruments, no days except both right ascensions and polar distances are observed."

"The number of days during the last year in which the moon has been observed at Greenwich are:—

With the Altitude and Azimuth Circle	= 203
,, Meridional Instruments	= 111

This statement gives only an imperfect idea of the value of the instrument. When the moon passes from 1 to 4 hours before or after the sun, there are 34 observations with the Altitude and Azimuth, and not one with the Transit and Circle.* It is not necessary to point out the immense utility of these results in the lunar theory, or to geography and navigation, which depend on lunar observations for their fundamental determinations.† The results of the observations, as reduced to the state of Apparent Errors of Tables in R.A. and N.P.D., appear very good; perhaps a little, and but a little, inferior to those of the Meridional Instruments.

Throughout the year 1847 the new form of star-reduction proposed by Mr. Airy as a substitute for Bessel's, (see *M. Notices*, vol. vii. p. 189,) has been used, and it has been found convenient. At present the assistants are employed in collecting all the star observations in 1842–1847, for the purpose of forming another grand catalogue reduced to the epoch 1845. The Astronomer Royal proposes to give in this catalogue the star-constants $e, f, g, h, l; e', f', g', h', l'$, and also, for a few years, the day-constants E, F, G, H, L, which are required by his method.

The reduction of Fallow's Cape Observations was commenced some time ago under the direction of the Astronomer Royal. This was interrupted by the work incident to the completion of the lunar reductions, but it will be resumed in a short time.

The ledgers of star-observations and occasional star-catalogues found in Maskelyne's Observations have been fairly written out. Mr. Airy submitted to the Visitors the propriety of printing these

* The working of this instrument is considered to absorb one assistant and one additional computer.

† When the Lunar Tables are made to satisfy the places of the moon given in the "Reduction of the Greenwich Lunar Observations," and are further corrected by observations made with the Azimuth and Altitude Instrument; well-observed Moon-culminations will not require *corresponding observations*, and occultations will yield trustworthy results *wherever* they may be observed.

reductions, and also suggested whether it might not be advisable to take some steps of calculation with respect to Bradley's Observations anterior to 1750.

In June last, the printing of the volume for 1846 was nearly finished, and the volume for 1847 was commenced.

Edinburgh.

Professor C. P. Smyth has been hitherto engaged in reducing and editing the observations of his lamented predecessor, and in examining and repairing the defects of his instruments and observatory. The meridian buildings are reported to be now in perfect order, and the instruments in a satisfactory state. It will be remembered that Professor Smyth has undertaken to determine the places of stars compared with the small planets and comets in extra-meridian observations, and when he is fully prepared (of which due notice will be given) it will be desirable that he should have early information of the approximate places of those stars, on which accurate and important comparisons depend.

The Astronomer Royal has communicated, and doubtless will continue to communicate, the mean right ascensions of the stars employed at Greenwich, so that the Edinburgh places will harmonise with those of Greenwich; or, as Professor Smyth remarks, "it will not work against but co-operate with Greenwich."

There seems reason to complain of the smoke of the city, but probably this will not very materially injure the great mass of observations. The transit has a noble object-glass $6\frac{1}{2}$ inches aperture, and the Professor proposes to use the circle with illuminated wires on a dark field.

The instability of the Edinburgh transit was suspected by Professor Henderson to arise from the effect of temperature on the foundation. Professor Smyth has traced it to a much simpler cause, a defective original construction of the Ys. He thus describes the construction of the new Ys:—

"They are large slabs of cast-iron, covering the whole area of the top of the pier, and weighing several hundredweight; there are no adjusting-screws, but the sides of the angles in which the pivots rest have been filed away, until the instrument is made to move as nearly in the plane of the meridian as could, perhaps, have been managed with screws. One good result has been certainly proved to have followed, viz. that the reversing of the instrument to obtain the error of collimation does *not* now sensibly throw it out in azimuth, which Professor Henderson used to complain of with the old Ys. Touching the fears that the new Ys might split the stone piers, and the hopes that they might correct the temperature fluctuations, there has not been sufficient time yet to settle that question through the medium of the large transit; it may, however, be considered to be pretty well set at rest by the experiments on the 30-inch transit. This was mounted on a similar huge block of cast iron screwed and cemented down to its pier,

on this it has now been sticking for a year, as firmly but as innocently as could be desired.

"The following is a list of azimuth errors of the 30-inch transit in its cast-iron block, as determined by *all* the transits of *α Ursæ Minoris*, observed on all five wires, during the period which elapsed from the final filing of the Ys to a snapping of two of the wires, which took place, it was supposed, from moisture: the clock star used on each occasion was *θ Ceti*:—

			s
1847.	Nov.	1	−0·091
		2	−0·003
		15	−0·058
		16	−0·040
		30	+0·043
	Dec.	14	+0·006
1848.	Jan.	7	+0·020
		13	−0·024

"Now these apparent fluctuations of the Ys in azimuth, which are very small, include the probable error with which each observation may be affected, by reason of the small optical power of the telescope and other matters inseparable from an inferior instrument. Hence they may be considered to be quite insignificant: taking them, however, as they are, and comparing them with the azimuth errors of the large transit in the corresponding period of the years 1841–2, the fluctuations of the large instrument turn out to be *five* times as great as those of the small one; a convincing proof that the cause of the changes hitherto remarked is not in the 'hill on which the observatory is built.' The above list of errors in azimuth may also convince observers that they may themselves rub down unadjustable Ys to limits which will be abundantly within easy calculation (and with transits, too, without micrometer wires).

"The Ys of the large transit having been erected, every screw about the instrument was tried to make sure that it was doing its duty: a number of the smaller ones (which seemed to be made of brass *wire*—drawn brass, not cast brass) were found quite rotten; these were replaced, and a good many new ones introduced about the sliding tubes at the eye end; handles for moving the instrument, and acting *only in the plane of the meridian*, were added; and then, as the line of soldering of the telescope was beginning to shew symptoms of oxidation, the instrument was painted. A nadir pier and mercury trough have been established, and a collimating eye-piece of peculiar construction, which, for perfect vision, seems to leave little to be desired, and reveals almost every affection of the instrument. On account of some of its revelations, the fixed wires have been removed, and five in their place mounted on the micrometer-frame. I propose to examine the errors of collimation and level every night, before and after the observations, as shall be found

necessary, and am now engaged in trying to cure the reversing-carriage of a trick it has got of throwing the instrument to the west during reversal. Collimating lenses, of the full aperture of the object-glass, for marks on the boundary wall, are also being put up, as the old semi-collimating semi-meridian marks are now seldom seen, on account of the increased smoke of the city; and when they are, the 6·5-inch aperture of the transit must be reduced to 2 inches, and the eye-piece pulled out so far as to make the wires very indistinct and unsteady."

Oxford.

The Radcliffe Observer has lately published his seventh annual volume. This consists, like the preceding volumes, chiefly of observations of circumpolar stars contained in Groombridge's Catalogue.

It is not necessary to dwell upon the merits of Groombridge's Catalogue, one of the most laborious tasks ever undertaken by an amateur, as well as one of the most useful. His Transit Circle, though perhaps rather weak as a right ascension instrument, was at the time of its construction, and for many years after, the most perfect instrument in existence for determinations in north polar distance. On this account, and considering that the time elapsed since Groombridge made his observations is sufficient to detect and exhibit proper motions, Mr. Johnson undertook to reobserve the Catalogue with great care, and has now nearly completed the task.

The north polar distances have almost all been re-determined, and a large portion of the right ascensions; there are, however, several gaps, occasioned by the necessity of observing certain circumpolar stars for meridian error, and fundamental stars for clock error. The increased number of well-determined stars will now allow the observer more liberty in this respect, and the blanks are rapidly filling up.

Besides the general advantage of a full standard catalogue of stars within 50° of the north pole, (which by the aid of Groombridge's determinations may be carried forwards for some years,) and the materials thus afforded for investigating precession, proper motion, &c. a special advantage will be found in geodesical operations from this large supply of accurate places for the zenith sector.*

Mr. Johnson expects very soon to receive the Heliometer by Repsold, when his attention will be directed to another department of practical astronomy. Thus limited in time, and having the aid of only one assistant, he has been induced to confine himself in most cases to *two* observations of a star in the same year,

* It is proper to remind observers who possess instruments not of the highest class, or who cannot afford the time for deducing fundamental places, that the partial catalogues in the Radcliffe Observations, will supply them abundantly with zone stars, from the pole to 50° of north polar distance, and that the volumes of the Edinburgh Observations will afford a sufficient number of similar stars, for a complete zodiacal catalogue. With these and the Greenwich catalogues there can be no want of a sound base of operations. Professor Argelander has made excellent use of the Radcliffe Observations in his admirable Zone Observations.

and occasionally to *one*. The star has, however, been observed in *different* years, so that there is a considerable check on errors of computation and on casual fluctuations in the instruments.

Care has generally been taken to note circumstances of interest connected with stars, which have come under observation. Among others, their magnitudes have been watched with much attention. The method adopted has been simply to estimate the apparent magnitudes in reference to *ideal* standards; and pending the discovery of some more accurate photometric measure, Mr. Johnson has instituted an inquiry as to the degree of reliance which may be placed on the method he has pursued. This inquiry has not yet been fully followed out, but the results, as far as they go, are given in the preface to the present volume. From what is there said, it may be inferred that Mr. Johnson would recommend that at every observation of a star, not distinctly visible to the naked eye, an estimate of its magnitude should be noted, unless there is some obvious impediment to a correct determination; and that a mean of such estimates should be taken as the magnitude of any given star, just as the mean of a number of observations in right ascension or north polar distance is considered as the correct right ascension or north polar distance.

Mr. Johnson acknowledges the great services which he has hitherto received in the voluntary revision of his work, first from Mr. Harris, our late assistant-secretary, and latterly from Mr. William Luff, of Oxford. Mr. Luff has most kindly undertaken to read the proof sheets and to revise the additions,* and, from the great care employed, it is hoped few typographical errors escape. When any errors are detected, Mr. Johnson hopes that they will be communicated to him.

The entire expense of printing these Observations is borne by the Radcliffe Trustees. The beautiful typography, and the convenient size of the volumes, enhance their value, and it is gratefully acknowledged that the Trustees distribute them liberally and judiciously.

Cambridge.

The Syndicate appointed to visit the Cambridge Observatory made a Report to the Senate, of which the following is the substance:—

The total number of observations in 1847 were,—

With the Transit,	.....	2540
,, Circle,	.....	2285
,, Northumberland Equatoreal	.....	1400

* "The process of revision is as follows:—Mr. Luff receives the proof sheet as soon as it comes from the printer. He goes over all the additions, without having the copy by him; he notes all the mistakes he finds; then the proof is collated with the copy and it is seen which are the mistakes of the printer and which of the copy. All being corrected, the proof is returned to the printer. The *revise* is carefully read over again, and no sheet is marked for *press* till it is clear of mistakes."

The observations with the Meridional Instruments are chiefly of the *Sun* (of which there is a very extensive series), *Moon*, *Jupiter*, *Saturn*, *Uranus*, and *Neptune*, with a good series of *Astræa*, *Flora*, and *Iris*. About 300 stars have been also observed.

The Equatoreal observations are for the most part of the minor planets and comets, which could not be seen on the meridian. These are, *Neptune*, *Astræa*, *Hebe*, *Iris*, *Flora*, and the following comets:—*Hind's*, Feb. 6; *Mauvais'* 3d; *Miss Mitchell's*; *Colla's*.

Professor Challis finds himself so much oppressed with unreduced and unpublished observations, that he has discontinued observations of the sun, moon, and the older planets, since the beginning of this year.* The recently-discovered planets are observed on the meridian and with the Northumberland Equatoreal, and the results communicated to the Royal Astronomical Society and to foreign Astronomers.

The Meridional Observations of 1847 are completely reduced. The Equatoreal Observations are less forward.

The volume for 1843 is nearly ready for publication. It does not contain the Equatoreal Observations, which are reserved for separate publication. Two Appendices are added; one containing so many of the observations made in search of the planet *Neptune* as are required to substantiate the statements given in the Special Report of Dec. 12, 1846; and the other a description of the Northumberland Telescope and Dome, drawn up by the Astronomer Royal.

Liverpool.

A very fine Equatoreal has recently been erected at the Liverpool Observatory. The general form of the instrument has been mentioned in former *Notices*, and it promises, so far as we have heard, to be the most accurate and most convenient instrument of its size now existing. The object-glass is by Merz of Munich, of eight inches aperture; and as it has been approved of by Messrs. Dawes and Lassell, most capable and somewhat fastidious judges, there can be no doubt of its superior excellence. In firmness and steadiness the equatoreal is reported to resemble a meridian instrument. The Hour-Circle is carried, as in the Northumberland telescope, by clock-work, and the right ascension is read off at once by the verniers. The Astronomer Royal, under whose direction the instrument was constructed, has given a perpetual motion to this hour-circle by clock-work moved by a water-wheel, to which a regulator is applied. The variation of the

* It is perhaps proper to inform those who are not acquainted with the University of Cambridge, that Professor Challis gives lectures during one term on Physics, and that he is largely engaged in the University examinations. His duties as lecturer and examiner *must* be attended to in the *first* place, whatever the Observatory business may be. The University cannot afford to give such a salary as will secure persons competent to carry on the computations without constant superintendence; and when an assistant has obtained the necessary acquirements, he is naturally and properly on the look out for a better place. It is not generally known how much mere heavy labour has been actually performed by the late and present professor.

clock does not exceed 1^s per hour. The declination and hour-circles are sufficiently good to give excellent results when objects are compared beyond the limits of the micrometer, an immense advantage when time is wanting and the weather is uncertain, and in all cases a great comfort, as it secures perfect identification.

We do not know certainly what line of astronomical research Mr. Hartnup will take up. He will do most wisely to follow his own inclination; but such an instrument would be very well employed in observing the planets for instance, especially the smaller planets, when they cannot be observed on the meridian at Greenwich. This would not only complete the series of the Greenwich Observations, but would greatly relieve the Cambridge Observatory, on which this branch of observing has of late pressed heavily.*

Extract of a letter from E. J. Cooper, Esq. Markree Castle.

"So long ago as the discovery of *Astræa*, I had it in contemplation to endeavour to perfect the maps in progress at Berlin, and by means of which that discovery was made, by including, as far as possible, all stars to 12th or 13th mag.; many circumstances combined to oblige me to defer this project. Upon receipt of the Berlin maps, I found that they ranged only 15° on each side of the equator, thus omitting a large portion of the ecliptic. My object being first to complete maps within a few degrees of the ecliptic, I was, of course, forced to adopt other maps in connexion with them. Our mapping proceeded as I had directed during most of the time of my recent absence from home; and when 18^h of right ascension came to the meridian at a convenient hour, Mr. Graham suggested the employment of his square-bar micrometer to enable us to lay down a number of standard points from which subsequently to fill in. I acceded at once to his proposition, and the result has been, for the past month of August, a collection of unpublished stars in the neighbourhood of the ecliptic to the number of 957, observed by me and Mr. Graham. For the reduction to 1850, we united with us my second assistant, Mr. C. Robertson; and by our collective work we have the catalogue ready for publication at this moment, without having lost any opportunity of increasing our stock. Indeed I believe that there are about 600 obtained during the last month. We consider that the probable mean error does not exceed $0^s.5$ on these observations; so they approximate quite sufficiently for any maps, or as data for discovery of planetary bodies."

Mr. Maclear has sent from the Cape of Good Hope the mean places of the stars which he compared with Mauvais' comet. See *Mem. Ast. Soc.* vol. xv. p. 242.

* It is desirable that a semi-public observatory like Liverpool should take a determinate line. We have every reason to admire the zeal and steadiness of our amateur observers, many of whom might be cited as models in these respects; but they ought not to be tied down to a strictness and continuity of research which must often be inconvenient and sometimes impossible.

Mr. Maclear has also forwarded mean places of the stars which Professor Mädler wished to have observed on account of suspected proper motion; along with Observations of *Uranus* and *Neptune* for 1847. These will be noticed in the next number.

Extract of a Letter from the Honourable Edmund Everett, President of the University of Cambridge, U.S.

"Our observatory has been spoken of, I am told, in the Annual Report of the Astronomical Society, as an establishment founded and supported by the state of Massachusetts. This is a mistake. The edifice was built by the university, and the great refractor bought by the proceeds of a subscription on the part of the merchants and friends of science in Boston and the vicinity. A few weeks since, a young gentleman of fortune died, leaving us a bequest of one hundred thousand dollars for the observatory."

A 12-inch altitude and azimuth instrument, an 8-inch sextant, and a theodolite, all by Troughton, the property of the late Admiral Shirreff, are now on sale, and may be seen at the Society's Apartments.

	£	s.	d.
Altitude and Azimuth Instrument....	25	0	0
Sextant	8	8	0
Theodolite	8	8	0

ERRATA.

In the *Monthly Notice*, No. 16 for June 1847, p. 284, *instead* of N.P.D. 102° 24′ 5″·7, which is the *apparent* N.P.D. of H.C. 43446, *read* N.P.D. 102° 24′ 27″·1. This is a different star from that in Bessel's Zones used on May 26.

See pp. 198, 200, for notice of errors respecting *Flora*.

See p. 222, for error respecting Observatory, Cambridge, U.S.

London:—Printed by George Barclay, Castle Street, Leicester Square.

INDEX

TO

VOL. VIII. OF THE MONTHLY NOTICES.

Page

Adams, J. C., ephemeris of *Neptune* 24, 172
Airy, G. B., results deduced from the occultations of stars and planets by the moon, observed at Cambridge from 1830 to 1835 29
———, corrections of the elements of the moon's orbit, deduced from the lunar observations made at the Royal Observatory of Greenwich, from 1750 to 1830 181
American observatories, notice respecting 88
Annual Report of Council, February 1848 57
Arrears, notice respecting 62
Associates, notice respecting 79
——— elected:—
Dr. P. H. L. Von Boguslawski 147
Dr. C. Bremiker ..... ib.
Dr. A. L. Busch ..... ib.
Dr. T. Clausen ..... ib.
Professor A. Colla ..... ib.
M. H. d'Arrest ..... ib.
M. Daussy ..... ib.
M. H. Faye ..... ib.
Dr. J. F. G. Galle ..... ib.
Dr. B. Goldschmidt ..... ib.
M. K. C. Hencke ..... ib.
Professor K. Knorre ..... ib.
M. Laugier ..... ib.
Professor J. H. Mädler ..... ib.
M. Mathieu ..... ib.
M. V. Mauvais ..... ib.
Dr. C. A. F. Peters ..... ib.
Dr. A. C. Petersen ..... ib.
M. K. C. Rümker ..... ib.
M. O. Von Struve ..... ib.
M. Max. Weisse ..... ib.
Astræa, observations of, by Messrs. Bishop and Hind 167
———, ———, by Professor Challis 205
———, ———, by M. Rümker 206
Aurora borealis, suggestion respecting, by Rev. J. Slatter 144

Binocular telescope, on the construction of, by Mr. Vallack 139
Biographical notice of Christian VIII. King of Denmark, Hon. Mem. 62
——— Miss Caroline Herschel, ditto 64
——— Dr. Dealtry, Ordinary Member 66
——— Captain Grover, ditto ..... ib.
——— Dr. Pearson, ditto 69
——— Admiral Shirreff, ditto 67

Page
Bombay observatory, on the transit instrument of, by Capt. Shortrede..... 52
Breen, H., jun., on the longitude of Poonah 154

Cambridge observatory, notices respecting 87, 219
Cambridge (U.S.) observatory, correction of an error respecting its foundation 222
Cape of Good Hope, notice of proceedings at 86, 187, 222
Ceres, Observations of MM. Rümker 150
Challis, Professor, on a method of calculating the orbit of a planet or comet from three observed places..... 49
———, ————, method of correcting equatorial observations for refraction 209
Chevallier, Rev. Professor, presentation of model of a time-ball 16
———, ————, on latitude of Durham observatory..... 154
———, ————, on an easy method of approximating to the distance of a planet from the sun, by means of two observations only, made near the planet's opposition 159
———, ————, on a regulated time-ball 160
Comet, Miss Mitchell's announcement of discovery of, October 1, 1847.... 9
———, —— ————, notice of ditto 81
———, observations of, by Rev. W. R. Dawes 10
———, ————, by MM. Littrow and Schaub ..... ib.
———, ————, by Professor W. C. Bond..... ib.
———, ————, by Professor Challis 25
———, ————, by M. Rümker 47
———, Miss Mitchell's, ephemeris of, by M. d'Arrest 11
———, —— ————, elements of, by ditto ..... ib.
———, —— ————, ————, by G. P. Bond ..... ib.
———, —— ————, ————, by MM. Rümker 25
———, —— ————, ————, by Mr. N. Pogson..... ib.
———, —— ————, ————, by M. G. Rümker..... 48
———, —— ————, ———— ————, by Miss Mitchell 130
———, Colla's, observations of, by MM. Littrow and Hornstein..... 12
———, ———, ————, by Professor Challis 26
———, ———, ————, by Mr. Lassell..... 26, 48
———, ———, elements of, by M. Littrow 12
———, ———, ephemeris of, by ditto ..... ib.
———, expected one of 1264 and 1556, sweeping ephemeris for.... 16, 24, 129
———, ————————————, extract of letter from Mr. Hind respecting 155
———, ————————————, notice of Mr. Hind's pamphlet respecting 181
———, Mauvais' third, notice of discovery of, July 4, 1847..... 80
———, ————, observations of, by Mr. Boreham..... 11
———, ————, ————, by Professor Challis 128, 144
———, ————, ————, by Professor Bond..... 129
———, ————, ————, by Mr. Lassell 143
———, ————, ————, by Messrs. Bishop and Hind..... 144
———, Brorsen's third, notice of discovery of, July 20, 1847 81
———, Schweizer's, notice of discovery, August 31, 1847 ..... ib.
———, ————, observations of, by M. Rümker 12
———, ————, elements of, by Mr. Pogson..... ib.
———, Encke's, notice respecting, by Mr. Hind..... 179
———, ———, ephemeris of, by M. d'Arrest 180
———, ———, ————, by Lieut. Stratford, R.N. 208
———, ———, observations of, by Professor Challis..... ib.
———, ———, ————, by Mr. Bishop and Mr. Hind..... 209
———, ———, notices of, by Professor Colla and Dr. Lee ..... ib.
———, first of 1847, parabolic elements of, by Mr. Pogson..... 181
———, Petersen's, notice of discovery of, August 7, 1848 207
———, ————, observations of, by Prof. Schumacher and Dr. Petersen ib.
———, ————, ————, by M. Rümker ..... ib.
———, ————, elements of, by MM. Sonntag and G. Rümker ..... ib.

Page

Comet, Petersen's, comparison of observations with ephemeris, by M. G. Rümker 208
———, on a method of calculating the orbit of, from three observed places, by Professor Challis 49
Cooper, E. J., observations of *Metis* 149
———, ——, extract of a letter from, respecting an extended catalogue of zodiacal stars 221

Dial, notice of a curious one belonging to Colonel Batty 161
Double stars, companion of *ν Scorpii* double, by Captain Jacob 16
——— ——, on two new ones, discovered by Mr. Dawes 53
——— ——, observations of *α Centauri* and other double stars, made at Poonah, by Capt. Jacob 134
——— ——, orbit and ephemeris of a binary one near μ^2 *Boötis*, by Mr. Hind 159
——— ——, notice of observations on 162
Drach, S. M., suggestion respecting seamen's watches 145
Durham observatory, notice respecting 88
———————, latitude of, by Professor Chevallier 154

Eclipse, lunar, remarkable appearances during the total one, March 19, 1848, observed by Mr. Forster and Mr. Walkey 132
———————, account of that of March 19, 1848, by Rev. C. Mayne 162
Eclipse, solar, observations of annular one of Oct. 9, 1847, by Mauvais and Schaub 13
———————, ———————, by Captain Jacob 27
———————, ———————, by Major Lysaght 130
———————, notice respecting 79
———————, of, April 15, 1847, observations of, by Capt. P. P. King, R.N. 15
———————, on beads in annular ones, by Professor B. Powell 28
Eclipses of Jupiter's first satellite, by Captain Bayfield 189
Edinburgh observatory, notices respecting 86, 216
ε *Indi*, M. d'Arrest on proper motion of 16
Errata in standard catalogues, notice of, by M. Faye 161

Fellows elected :—
Rev. J. Slatter 1
Captain F. Blackwood 17
E. J. Lowe 33
Thos. C. Jansen 125
R. Hodgson 141
W. A. Cross ..... ib.
W. H. Palmer ..... ib.
Rev. T. P. Dale 147
Major T. V. Lysaght ..... ib.
S. Fenwick ..... ib.
Rev. H. H. Jones ..... ib.
Flora, announcement of discovery of, by Mr. Hind, Oct. 18, 1847 ..... 1, 82
——, observations of, by Professor Challis 1, 17, 141, 163, 197
——, ———————, corrections of do. at p. 163 198
——, ———————, by E. J. Cooper, Esq. and Mr. Graham 2, 165
——, ———————, by Professor Encke 2
——, ———————, by Professor Schumacher and M. Petersen ..... ib.
——, ———————, by MM. Rümker 3, 33, 34, 126, 153
——, ———————, by Messrs. Bishop and Hind 17
——, ———————, by Professor Gauss 33
——, ———————, by Lieutenant M. F. Maury 34
——, ———————, by Sir T. M. Brisbane and Mr. Brown 125
——, ———————, ——————— and Mr. Welsh 199
——, ———————, by Professor Chevallier and Mr. Thompson 126, 153
——, elements of, by Mr. Hind 18
——, ———————, by M. d'Arrest ..... ib.
——, ———————, by Mr. Graham 35

Page
Flora, elements of, by Dr. Brunnow 127
——, ————, by Mr. Boreham 141
——, ephemeris of, by Mr. Hind 19, 35

Galloway, T. notice of his paper on the proper motion of the solar system .. 90
Greenwich lunar reductions, note respecting 181
———— royal observatory, notices respecting 82, 215
————————, account of new altitude and azimuth instrument at 84

Hansen, Professor, on two inequalities in the motion of the moon, notice respecting..... 89
Hartwell, longitude of, from meridian observations of the moon, by Mr. T. Dell 154
Hebe, notice of discovery, by M. Hencke, July 1, 1847 ..... 81, 103
——, observations of, by Professor Challis..... 20, 203
——, ————, by Sir T. M. Brisbane 20
——, ————, by Lieutenant M. F. Maury..... 40
——, ————, by M. Rümker 204
Henry, Mr. on the annual oscillations of the level and azimuthal errors of the Greenwich and Cambridge transit instruments..... 134
Herschel, Sir J. F. W., extract of letter from, respecting Mr. Griesbach's communication on the solar spots 14
————————, address on the award of the testimonials to M. Hansen, Professor Hencke, Mr. Hind, Mr. Bishop, Sir John Lubbock, M. Le Verrier, Mr. Adams, Professor Argelander, Mr. Airy, Colonel Everest, and M. Weisse 96
Himalayas, on the disturbing force of the, by Captain Shortrede 189
Hind, J. R., announcement of discovery of *Flora*, Oct. 18, 1847..... 1
————, discovery of new star in *Ophiuchus*..... 146
————, letter on the expected comet of 1264 and 1556..... 155
————, —— respecting his changing star 155, 157, 192
————, orbit of binary star near μ^2 *Boötis*..... 159
————, notice of Encke's comet 209
Histoire Céleste and Lacaille's Southern Catalogue, notice of 84
Hönegger, T. B., notice respecting a Punic monument discovered by 192
Honorary members elected :—
His Majesty the King of Denmark 145
His Grace the Duke of Northumberland ..... ib.
Baron von Senftenberg ..... ib.

Instruments on sale, notice respecting 222
Iris, notice of discovery by Mr. Hind, Aug. 13, 1847 81
——, observations of, by E. J. Cooper, Esq. and Mr. Graham 3
——, ————, by MM. Rümker..... 4, 41, 204
——, ————, by Professor Challis..... 21, 142, 204
——, ————, by Sir T. M. Brisbane 21
——, ————, by Professor Chevallier and Mr. Thompson 127
——, ————, by Professor Kaiser 151
——, ————, by Mr. Bishop and Mr. Hind 205
——, ephemeris of, by M. d'Arrest..... 5
——, ————, by Mr. Hind 22
——, ————, at her reappearance, by Mr. Hind 168
——, elements of, by Mr. Graham 41
——, extract of letter from Mr. Cooper respecting 127

Lassell, W., discovery of new satellite of *Saturn* 195
————, notice of his polishing machine 197
Latitude of Durham observatory 154
Lee, Dr., extract of letter from, presenting a portrait of Mr. Joseph Middleton, founder of the Mathematical Society, Spitalfields 191
Le Verrier, M., on comets of short period, notice respecting..... 89
Liverpool observatory, notices respecting 87, 220

Page
Longitudes of Tahlee, Port Stephen's, New South Wales 15
———— Port Essington, New South Wales 54
———— Raine's Island 54
———— Nepean Island, Torres Straits ..... ib.
———— Darnley Island ..... ib.
———— Poonah 154
———— Hartwell ..... ib.
———— Observatory Bastion, Quebec 188
———— on difference of, between Paramatta and Port M'Quarrie 188
Lubbock, Sir J. W., on the perturbations of planets and comets 120

Machine for giving time at places in sight of each other, working model of, presented by Professor Chevallier 16
Maclear, T., extract of letter from, respecting observations of stars in Professor Mädler's list 133
————, notice respecting observations by 187
————, ———— mean places of stars compared with Mauvais' comet 221
————, ———— observed for proper motion 222
Memoirs and Monthly Notices, notice respecting 60
Metis, notice of discovery of, by Mr. Graham, April 25, 1848 ..... 146, 147
——, note on proposed name, by Mr. Graham 147
——, observations of, by MM. Cooper and Graham 149, 174
——, ————, by Professor Schumacher and Dr. Petersen 149
——, ————, by MM. Rümker 149, 177
——, ————, by Professor Chevallier and Mr. Thompson 150
——, ————, by Messrs. Hind and Reade ..... ib.
——, ————, by Messrs. Bishop and Hind ..... ib.
——, ————, by Professor Challis 176, 206
——, ephemeris of, by Mr. Graham 148, 178
——, elements of, by ditto 148
——, ————, by Dr. Brunnow 178
——, ————, by Dr. B. A. Gould 178
Moon, account of self-luminous spot in the, by Mr. Hodgson 55
——, observations of the, and stars near her path, by Professor Jahn 153
——, ————, by MM. Rümker 153
——, correction of the elements of orbit of, &c., by the Astronomer Royal 181

Neptune, notice respecting 110
————, observations of, by Professor Chevallier and Mr. Thompson 6, 128, 201
————, ————, by MM. Rümker 7, 37, 128, 172
————, ————, by Capt. Jacob 7
————, ————, by Professor Challis 22, 142, 172, 201
————, ————, by Sir T. M. Brisbane 23
————, ————, by M. Geo. Rümker 37
————, Lassell's satellite of, observations of, by Mr. Lassell 8
————, ————, ————, by Professor W. C. Bond .. 9
————, elements of, by Dr. Pierce 188
————, ephemeris of, by Mr. Adams 24, 172
————, elliptic elements of, by Professor S. C. Walker 38, 202
————, perturbations of, by Professor Pierce 38
Newton, Sir I., description of Rev. C. Turnor's monument to 32

Observatories, notice respecting several private ones 88
————, —— of the principal English ones 211
Occultations of fixed stars observed by M. Rümker 133
———————— by Capt. Jacob ..... ib.
———————— by Capt. Bayfield 188
———— memoir on observations made at Cambridge by the Astronomer Royal 29
Orion, great nebula in, letter from Rev. W. R. Dawes respecting 31

Page
Oxford observations, notice of 87
——— observatory, notice of 219

Pallas, observations of, by MM. Rümker 151
Pearson, Dr., his bequest, notices respecting 163, 195
Perturbations of planets and comets, Sir John Lubbock on 120
Poona, longitude of, computed by Mr. H. Breen 154
Powell, Rev. Professor, on beads in annular eclipses 28
Pulkowa, brief notice of the observatory of 50
———, letter from M. O. Von Struve respecting 139

Saturn, satellites of, observations of, by Mr. Lassell 42
———, discovery of new satellite of, by ditto 195
Star, new one in *Ophiuchus*, notices of, by Mr. Hind 146, 150, 192
——, notices respecting, by Professor Challis, Mr. Woollgar, Dr. Petersen, M. Rümker, Mr. Graham, and Mr. Weld 156, 157, 211
——, supposed variable 127, 192
——, ——— lost 16
Shortrede, Capt., on a formula for reducing observations in azimuth of circumpolar stars near elongation, to the azimuth at the greatest elongation 160
———————, observations to determine the latitude of Dera, and the disturbing force of the Himalayas 189
———————, to find the error and rate of a chronometer from the observed transits of three stars near the meridian .. 191
Society, receipts and expenditure of the, 1847–8 58
———, stock of volumes of the Memoirs ..... ib.
———, number of Fellows and Associates 59
———, distribution of the instruments belonging to the ..... ib.
———, titles of papers read before the 96
———, list of contributors to the library of the 100
———, ——— officers and council of the 122
Solar spots, Mr. J. H. Griesbach's letter on 14
———————, Sir J. F. Herschel's letter on ..... ib.
———————, notice respecting 80, 162
———————, Mr. Weld's observation of 210
Special general meeting respecting expulsion of Fellows for non-payment of arrears 123
——————————— to elect honorary members, and to expel defaulters 145
Standard scale, notice respecting 83
Stanley, Capt. O., on the difference in longitude between the observatory of Paramatta and Port M'Quarrie 188
Struve, M. Von, notice of his Etudes d'Astronomie Stellaire 91
———, M. O. Von, on the satellites of *Uranus*, &c. 44, 139

Testimonial, notice of proceedings respecting 74
———————, award of ditto to Sir John Herschel 77
———————, President's address on award of ditto 102
Time-ball, regulated motion of, by Professor Chevallier 16
Transit instrument, on that of the Bombay observatory, by Capt. Shortrede 52
———————, on the oscillations in the adjustments of the Greenwich and Cambridge transits, by Mr. Henry 134
Turnor, Rev. Charles, his obelisk to Newton described 32

Uranus, satellites of, observations by Mr. Lassell 43
———, ———, note on, by M. Otto Von Struve 44
———, observations of, by M. Rümker 127
———, letter respecting, by O. Von Struve 139
———, on the interior satellites of, by Rev. W. R. Dawes 135
———, perturbations of, accounted for by *Neptune*, Professor Pierce 202

Zodiacal stars, on an extended catalogue of, by E. J. Cooper, Esq. 221

ERRATA.

Vol. VII. p. 284, *instead of* N.P.D. 102° 24′ 5″·7 (which is the apparent N.P.D. of H.C. 43446,) *read* N.P.D. 102° 24′ 27″·1. This is a different star from that in Bessel's Zones, used on May 26.

— — 307, *for* sixth satellite of *Saturn*, *read* the most distant satellite.

Vol. VIII. — 36, the sign of the corr. for aberr. in N.P.D. must be changed throughout: it was computed for declination, and not altered.

— — 130, line 10, *for* November, *read* October.

— — 126. The observations of *Flora* at the Durham Observatory are corrected for refraction, but not for parallax.

— — 147, line 4, *for* St. Vidart, *read* St. Vedast.

— — 156, *for* Weisse's Bessel, xvi. 956, *read* xvi. 962.

— — 157, line 1, *for* Piazzi, xvii. 191, *read* xvi. 191, 20 *Ophiuchi*.

The star of about 6 magnitude mentioned just afterwards is H.C. 31188 = Bode 133 Ophiuchi, 5 mag.

— — 161, line 13 from the bottom, *for* 1542, *read* 1548.

See pp. 198, 200, for notice of errors respecting *Flora*.

— p. 222, for error respecting the observatory of Cambridge, U. S.

R XII. 2